

## Reaction Wheel Disturbance Model Extraction Software, Phase II

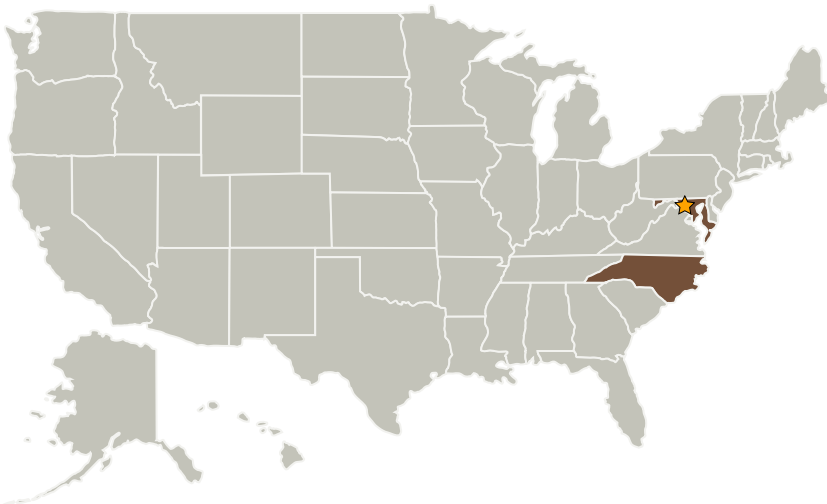
Completed Technology Project (2007 - 2009)



## Project Introduction

Reaction wheel mechanical noise is one of the largest sources of disturbance forcing on space-based observatories. Such noise arises from mass imbalance, bearing imperfections, and other sources. It takes the form of a number of discrete harmonics of the wheel speed, often also with a broadband noise component. Jitter problems can arise when harmonics sweep across observatory modes, and can be exacerbated by gyroscopically coupled spin-rate-dependent wheel structural modes that dynamically amplify the tonal and broadband disturbances. For a well-balanced wheel, higher harmonic forces can be on the same order as the fundamental, therefore when there is a jitter problem it can occur at very low wheel speed. These higher harmonics are generally less well-characterized than the fundamental. The proposed Reaction Wheel Disturbance Model Extraction Software (RWD MES) is a tool for fitting a hybrid physical/empirical model to wheel induced-vibration data. The physical model captures the wheel structure including gyroscopic effects, while the empirical model captures the harmonic forcing and broadband noise. The Phase I effort demonstrated the ability to fit a highly accurate harmonic/broadband/structural model, including 43 harmonics up to 14.63 times the fundamental, to measured wheel disturbance data in a point-and-click environment in about 2 hours. The benefits of the technology include reduced program effort to produce wheel disturbance models, leading to more accurate jitter prediction earlier in a mission. This in turn allows jitter problems to be mitigated at the design stage when changes are relatively inexpensive.

## Primary U.S. Work Locations and Key Partners



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## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Organizational Responsibility	1
Project Transitions	2
Project Management	2
Technology Areas	2

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Goddard Space Flight Center (GSFC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Nightsky Systems, Inc.	Supporting Organization	Industry	Raleigh, North Carolina

Primary U.S. Work Locations	
Maryland	North Carolina

## Project Transitions

**December 2007:** Project Start**December 2009:** Closed out

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX04 Robotic Systems
  - └ TX04.2 Mobility
    - └ TX04.2.5 Robot Navigation and Path Planning